Science News *from research organizations*

A hidden brain problem may be an early warning for Alzheimer's

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Summary: Researchers discovered that clogged brain "drains" show up early in people at risk of Alzheimer's disease. These blockages, easily seen on standard MRI scans, are tied to toxic protein buildup linked to memory loss and cognitive decline. In some cases, they may signal Alzheimer's earlier than other commonly used brain markers. This could help physicians detect the disease earlier, before irreversible damage sets in.

FULL STORY

Clogged brain "drains" seen on MRI scans could be an early red flag for Alzheimer's—before memory loss even takes hold. Credit: Shutterstock

Scientists from Nanyang Technological University, Singapore (NTU Singapore) have found that the brain's waste removal system often becomes blocked in people who show early signs of Alzheimer's disease. These blockages interfere with the brain's ability to clear harmful substances and may appear well before clear dementia symptoms develop.

The clogged pathways are known as "enlarged perivascular spaces," and the findings suggest they could serve as an early warning signal for Alzheimer's, the most common form of dementia.

"Since these brain anomalies can be visually identified on routine magnetic resonance imaging (MRI) scans performed to evaluate cognitive decline, identifying them could complement existing methods to detect Alzheimer's earlier, without having to do and pay for additional tests," said Associate Professor Nagaendran Kandiah from NTU's Lee Kong Chian School of Medicine (LKCMedicine), who led the study.

Justin Ong, a fifth-year LKCMedicine student and the study's first author, emphasized the importance of early detection. He noted that identifying Alzheimer's sooner gives doctors more time to intervene and potentially slow the progression of symptoms such as memory loss, reduced thinking speed, and mood changes. The research was conducted as part of LKCMedicine's Scholarly Project module in the School's Bachelor of Medicine and Bachelor of Surgery programme.

Why Studying Asian Populations Matters

The study stands out because it focuses on Asian populations, an area that has been underrepresented in Alzheimer's research. Most existing studies have concentrated on Caucasian participants, which may limit how broadly their findings apply.

The NTU team examined nearly 1,000 people in Singapore from different ethnic backgrounds that reflect the country's population. Participants included individuals with normal cognitive function as well as those experiencing mild thinking difficulties.

Research has shown that dementia does not affect all ethnic groups in the same way, making region specific studies essential.

"For example, among Caucasians with dementia, past studies show that the prevalence of a major risk gene, apolipoprotein E4, linked to Alzheimer's is around 50 to 60 percent. But among Singapore dementia patients, it is less than 20 percent," said Assoc Prof Kandiah, who is also Director of the Dementia Research Centre (Singapore) in LKCMedicine. Because of these differences, findings in one population may not directly apply to another.

How the Brain Clears Toxic Waste

Inside the brain, blood vessels are surrounded by small channels called perivascular spaces. These spaces help drain toxic waste products, including beta amyloid and tau proteins, which are found in high levels in people with Alzheimer's disease.

When the brain's waste removal system becomes less efficient, these spaces can enlarge and become visible on MRI scans. Until now, it was unclear whether this change was directly linked to dementia, particularly Alzheimer's disease.

To answer this question, the NTU researchers compared enlarged perivascular spaces with multiple established indicators of Alzheimer's. They also examined how these clogged drainage pathways relate to well known disease markers such as beta amyloid buildup and damage to the brain's white matter, the network of nerve fibers that connects different brain regions.

Comparing Healthy Brains and Early Cognitive Decline

The study included nearly 350 participants with normal thinking abilities, including memory, reasoning, decision making, and focus. The remaining participants showed signs of early cognitive decline, including mild cognitive impairment, a condition that often precedes dementia.

Previous research has shown that people with mild cognitive impairment face a higher risk of developing Alzheimer's disease or vascular dementia, which is caused by reduced blood flow to the brain.

After analyzing MRI scans, the researchers found that participants with mild cognitive impairment were more likely to have enlarged perivascular spaces than those with no cognitive problems.

Blood Markers Strengthen the Link

In addition to brain scans, the scientists measured seven Alzheimer's related biochemicals in participants' blood, including beta amyloid and tau proteins. Elevated levels of these substances are considered warning signs of Alzheimer's disease.

Enlarged perivascular spaces were linked to four of the seven biochemical measurements. This suggests that people with clogged brain drains are more likely to have increased amyloid plaques, tau tangles, and damage to brain cells, placing them at greater risk of developing Alzheimer's.

The researchers also looked at white matter damage, a widely used indicator of Alzheimer's, and found it was associated with six of the seven blood markers. However, further analysis revealed something unexpected.

Among participants with mild cognitive impairment, the connection between Alzheimer's related biochemicals and enlarged perivascular spaces was stronger than the connection with white matter damage. This finding points to clogged brain drainage as a particularly early signal of Alzheimer's disease.

Implications for Diagnosis and Treatment

These insights may help doctors make more informed decisions about early treatment strategies, potentially slowing disease progression before lasting brain damage occurs.

"The findings carry substantial clinical implications," said Assoc Prof Kandiah. "Although white matter damage is more widely used in clinical practice to evaluate for dementia, as it is easily recognised on MRI scans, our results suggest that enlarged perivascular spaces may hold unique value in detecting early signs of Alzheimer's disease."

Dr. Rachel Cheong Chin Yee, a Senior Consultant and Deputy Head at Khoo Teck Puat Hospital's Department of Geriatric Medicine, said the study highlights the role of small blood vessel changes in Alzheimer's development.

"These findings are significant because they suggest that brain scans showing enlarged perivascular spaces could potentially help identify people at higher risk of Alzheimer's disease, even before symptoms appear," said Dr. Cheong, who was not involved in the research.

Rethinking Brain Vessel Disease and Alzheimer's

Dr. Chong Yao Feng, a Consultant at the National University Hospital's Division of Neurology who was also not involved in the study, noted that cerebrovascular diseases and Alzheimer's disease have traditionally been viewed as separate conditions.

"The study's findings are intriguing as they demonstrate that both diseases do interact in a synergistic manner," said Dr. Chong, who is also a Clinical Assistant Professor at the National University of Singapore's Yong Loo Lin School of Medicine.

As a result, doctors reviewing MRI scans should be cautious about assuming cognitive symptoms are caused only by blood vessel problems when markers such as enlarged perivascular spaces are present. These features may also signal a higher risk of Alzheimer's disease.

"Doctors will then have to use their clinical judgement of the patient's scan and symptoms, as well as discuss with the patient, to determine if more checks are needed to confirm whether a patient has Alzheimer's disease or not," said Dr. Chong.

What Comes Next

The NTU research team plans to track participants over time to determine how many eventually develop Alzheimer's dementia. This follow up will help confirm whether enlarged perivascular spaces can reliably predict progression to dementia.

If future studies in other populations reach similar conclusions, identifying clogged brain drains on MRI scans could become a routine tool for detecting Alzheimer's risk much earlier than is currently possible.

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Journal Reference:

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